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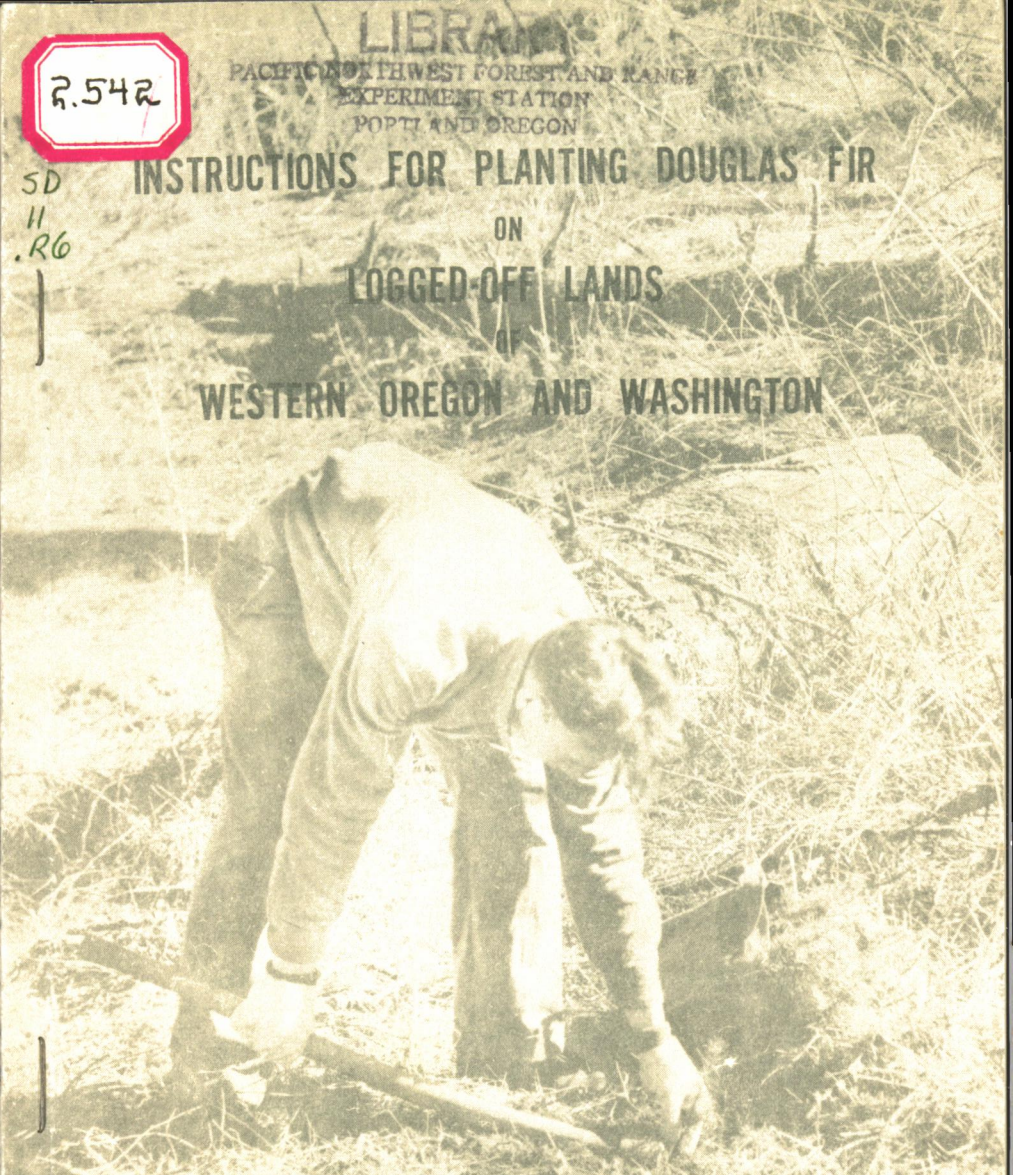
# INSTRUCTIONS FOR PLANTING DOUGLAS FIR ON LOGGED-OFF LANDS OF WESTERN OREGON AND WASHINGTON



PREPARED BY
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PORTLAND, OREGON
AUGUST 1942

## FOREWORD

This pamphlet is intended as a field handbook for the use of men on tree-planting projects in the Douglas-fir region. It is not a complete treatise on reforestation and does not attempt to cover the many variations of technique or the methods applicable to special cases. It embodies the results of many years of experience and research of various agencies. In the preparation of this manuscript the author, Thornton T. Munger, has had the benefit of suggestions from several authorities, especially Charles E. Reynolds of the West Coast Lumbermen's Association, D. G. McKeever of the Weyerhaeuser Timber Company, A. W. Moore of the Fish & Wildlife Service, and C. A. Rindt, W. F. Will, and L. A. Isaac of the Forest Service.

# INSTRUCTIONS FOR PLANTING DOUGLAS-FIR ON LOGGED-OFF LANDS OF WESTERN OREGON AND WASHINGTON

## For Use of Crew Foremen and Project Superintendents

## CONTENTS


| | | Page No. |
|---|---|---|
| I. | Mapping of Area to be Planted | 1 |
| II. | Pre-planting Animal Control | 4 |
| III. | Types of Land to be Planted | 4 |
| IV. | Care of Trees on Arrival at Project | 6 |
| V. | Organization of Planting Crew | 8 |
| VI. | Duties of Foremen | 8 |
| VII. | Project Superintendent | 9 |
| VIII. | Tools | 10 |
| IX. | Lining Up Planters | 10 |
| X. | Setting of Trees | 13 |
| XI. | Spacing of Rows and Trees | 17 |
| XII. | Attention After Planting | 19 |
| XIII. | Reports | 20 |


## I. Mapping of Area to be Planted

Some time before planting is begun a detailed reconnaissance and map of an area proposed for artificial reforestation should be made (unless there is known to be a total absence of reproduction over a considerable area) to determine which areas are already stocked with seedlings and which are not. For a large tract of logged-off land the pattern of the non-stocked land is often very irregular, following the outlines of a second burn, of the area logged during a poor seed year, or of the drier and hotter slopes.

A suggested procedure for mapping the area in need of reforestation is as follows:

1. Select an area that from quick examination appears to be devoid of seedlings or saplings and is not likely to reforest naturally, excepting areas within range of a seed supply which have not yet had time since logging and burning to become reseeded naturally--4 or 5 years.

2. Do the field work in the late fall, winter, or early spring, when the weeds are dead and the leaves off.

3. One man working alone should gridiron the tract with traverses in cardinal directions not over 5 chains apart, his equipment being compass and staff, tally register, the best existing base maps, sketch board or map sheets in holder.

4. Proceeding along the strip, the examiner will map the stocking of conifer seedlings as he sees them by close examination on his line and by more casual examination at either side for a distance of 165 feet, especially in questionable areas.

5. For the purpose of mapping and designating areas to be planted, natural stocking should be recorded on the basis of density to suit the standards of the project. Two or more percentages of stocking may be recognized.

The following is an example of procedure based on the stocked quadrat concept of stocking, considering less than 10 percent stocking as non-stocked, 10 to 40 percent stocking unsatisfactory, and over 40 percent stocking satisfactory:

Consider the whole area consisting of 13.2 x 13.2 foot squares (each 1/250 of an acre). If an established tree seedling occurs on a square it is considered stocked. If only 1 or less out of 10 squares are stocked it is considered "non-stocked". If 4 or more out of 10 are stocked it is considered "stocked" and not in need of planting. On the strips the examiner should stop every chain or two and look at the 4 contiguous quadrats of which his stopping point is the central common corner. If a quadrat has even 1 established seedling it is tallied as stocked. By keeping a record of the number of quadrats stocked at each stop (tallied 0, 1, 2, 3, or 4) and entered on his sketch map in place the examiner will have a precise figure of the degree of stocking and a good check on his ocular estimate of the degree of stocking at the sides of the line and of the transition points from stocked to non-stocked areas. One-year-old seedlings are not considered as "established" and three 1-year-old Douglas-firs or at least 5 hemlocks per quadrat will be rated as equivalent to 1 established seedling.

6. The examiner should also indicate on his sketch map features that may affect the conduct of the planting, such as roads, creeks, swamps, rock outcrops, and bodies of standing timber.

7. On the completion of the stripping a map or plat can be prepared (in color) showing the non-stocked, the stocked, and the intermediate poorly-stocked areas for the guidance of the planters. The last class may or may not be planted according to the policy on the project. More detailed typing of the degrees of stocking may, of course, be done.

## II. Pre-planting Animal Control

Since various animals are exceedingly destructive of planted trees, especially rabbits, mountain beaver, and deer, it may be necessary to control or reduce their numbers before planting is begun. Several means may be employed:

(a) Coating a portion of the trees with a repellent or poisonous compound--best done at the nursery before the trees are dug up.

(b) Encouraging the hunting of deer in a legal fashion.

(c) Discouraging the hunting and trapping of coyotes and cats that help to keep down the population of rodents.

(d) Poisoning rabbits and mountain beaver. Where these pests are thought to be so bad that some control is necessary, special instructions therefor may be had from the Rodent Control Division of the Fish and Wildlife Service, at Olympia or Portland for Washington and Oregon respectively, or that Service might make an examination of the area and recommend the proper treatment.

Fall planting (in regions where there is no continuous snow blanket) has the disadvantage, in comparison with early spring planting, of exposing the trees to animal depredations for a longer period when there is less other green feed.

## III. Types of Land to be Planted and Not Planted

The planting map will show in a general way what areas are to be planted, i.e., the non-stocked and, in some cases, some of the poorly-stocked areas. The planting squads should be further

Planting hoes, planting bag, and 12 bales of Douglas-firs--3600 trees at the planting camp.

Heeling-in trees at the planting camp; the small bundles of trees are opened and the trees spread in a thin layer since they are to be held there some time.

instructed not to plant the following classes of land, when encountered, as an economy of time and planting stock:

(a) Areas within 500 feet of a body of seed-bearing timber or numerous seed trees, (except where poor site conditions are precluding regeneration by natural seeding).

(b) Swamps unsuitable to the species being planted.

(c) Rock outcrops, thin-soiled spots, and piles of bark at landings.

(d) Thickets of alder, maple, or evergreen brush.

(e) A strip within 10 or 12 feet of a used roadway.

## IV. Care of Trees on Arrival at Planting Project

Immediately after the planting stock arrives from the nursery at the planting project it should be properly stored awaiting its use. This should be done by "heeling" it in as follows:

1. At the planting camp or other place convenient to the job, select a level area in the shade or part-shade, if possible, where the soil is easily dug and well drained, and a water supply is at hand.

2. Dig one or more parallel trenches about a foot wide and a foot deep, with one side sloping at a 60° angle and as long as needed.

3. Open the crates, bales, or boxes of trees, remove the packing, and soak the roots with water.

4. If the trees are tied in bundles do not cut the string unless they are very large, the trees show a tendency to mould or heat, or are to be left heeled-in over 10 days. Place the trees in a thin layer along the sloping side of the trench, with their normal ground line just below the level of the ground. Place a 2- or 3-inch layer of dirt on the roots and pack down with the heel; add another layer of trees by digging from the opposite side of the trench. Repeat until there are not over 6 or 8 layers in one trench, then fill the trench with soil and pack down firmly so that drying air is excluded from the roots.

5. If the soil or air is dry, wet the soil thoroughly at once and every day or two thereafter as needed.

6. Different species or lots should be kept in separate blocks, and the oldest lots used first.

7. If the heeled-in trees are not in the shade and they are to be left several days, erect over them a framework 2 feet high covered with brush or boughs. Do not cover with a tarp, because that shuts off ventilation but not heat.

8. It is assumed that the stock will be root-trimmed to a standard length and culls sorted out before shipment from the nursery. If these operations have not been done provision should be made for doing this on the job under special technical instructions issued by the forester for the project.

9. If trees are to be held in the field beyond the period when growth normally starts in the spring, they should be held in iced storage below 40° F. New growth will not start

below that temperature and damaging moulds will not attack the stored trees. Trees cannot be held dormant nor safely stored above that temperature.

## V. Selection and Organization of Planting Crew

1. The size of the planting crew will be governed by the number of trees to be planted and the length of time that the weather will allow for the job. In figuring the number of men needed assume that each planter will plant from 500 to 900 trees per 8-hour day, depending on soil, topography, weather, crew efficiency, and size of stock.

2. A crew of less than 10 men is inefficient, except where there are 2 or 3 experienced men who can work without overhead and without maintaining a camp or special transportation facilities.

3. The best type of laborers for this work are young able-bodied men (not boys) who are used to bending their backs, are quick on their feet, and are interested in the job, like local residents and forestry students.

4. The planters should be organized into squads of 10 to 15 men, each with a foreman, who should be a good instructor and leader.

## VI. Duties of Foremen

The duties of the foremen are:

1. To take care of the supply of trees and the tools.

2. To see that his squad covers the area prescribed in the planting plan.

3. To keep his men properly lined up by setting guide flags or otherwise.

4. To instruct his men in planting technique and to give constant supervision to see that each man does good planting and that the trees in his planting bag are properly covered and wet.

5. To see that no unnecessary planting is done on stocked areas or on unfavorable ground.

6. To plant occasionally in the place of a man who needs to take 5 minutes off, so as to keep the line moving uniformly.

7. To arrange to have drinking water at stated intervals so that the men may not have to carry canteens.

8. In small projects employing only one squad the foreman will act as project superintendent also.

VII. Project Superintendent

In projects of 20 men or more there should be a project superintendent whose duties are:

1. To arrange for transportation of men and materials and to run the camp, if any.

2. To allot the areas to be planted by each squad and keep track of the area covered.

3. To currently inspect the quality of the planting workmanship of each squad. To do this pull at the freshly planted trees to see if they are firmly tamped in and dig up a few trees at random to see if the roots are straight in the hole.

4. To prepare necessary progress maps and reports.

## VIII. Tools

Each planting squad of 10 planters and a foreman should have the following equipment:

(a) Ten (and some extra) grub hoes with a 4-inch wide blade, the blade of which has been straightened by a blacksmith to a right angle with the handle.

(b) Ten bags, of canvas or other stout waterproof cloth, in which to carry the trees and some wet packing, preferably with 2 compartments; canvas waterbuckets will do; metal pails are not convenient.

(c) Two water bags (or individual canteens), unless creeks are abundant, for wetting the trees and for drinking, to be kept at the end of the strips.

(d) For the foreman a compass, map, notebook, belt axe, tally register, cloth for guide flags, 6- or 8-foot measuring pole.

## IX. Lining Up Planters

The squad of planters (not over 15) should be lined up 8 feet apart (or whatever is the interval between rows) and proceed across the area being planted as a unit, approximately abreast, observing the following principles:

1. A good, steady, systematic worker should be put on either the right or left end; he is the guide for the others, sets the pace, and plants the first tree on each course. An experienced, good worker should also be on the other end of the line.

A crew of 10 men with their foreman planting an old burn, using the one-man grub-hoe method.

2. The man next to the guide keeps the proper distance from him and as near abreast as possible (but never more than a tree ahead) and so on across the squad.

3. To assure good spacing between rows, each man should be slightly behind his neighbor on one side, so that the planter on the end opposite the guide will be a tree or two behind him.

4. In order to take the proper course across the area to be planted, the foreman will set a flag or series of flags--pieces of white or yellow cloth--stuck up on poles or bushes for the guide to steer for on the first row. After the crew passes a line marker flag, the foreman will move it over to mark the line for the return trip of the planting crew, or, if the foreman is otherwise engaged the guide will pick up the flag and have it passed down the line to the man on the opposite end who will set it up on the line of the first row for the return trip.

5. On small tracts in easy topography, flags may not be needed; instead the foreman can point out a landmark for the guide to steer for, or sometimes there is a natural boundary like a creek, trail, or ridge for the first row; then each succeeding course can be followed by paralleling at the proper distance the last row planted.

6. When the strip across the area to be planted has been completed the squad will move over and reverse its direction; the guide man will go back next the last row planted, following the new line of flags, if any. Each planter will have the same men next to him.

7. In steep country it is better to proceed up and down the slope, than along the contours. In very steep country (where downhill travel is rapid) it may be advantageous for the crew to walk back to the foot of the slope and plant only on the up-hill trip.

8. There should be no smoking on the line, but at stated intervals, usually once an hour preferably at the end of a row, a 5-minute rest will be taken and smoking allowed with proper precautions against fire.

## X. Setting of Trees by the One-man Grub-hoe Slit Method

1. When the planters are ready to start work in the morning, each should take enough trees to last until refills can be made without loss of planting time.

2. One bundle of trees should be opened, the trees separated, and put in one compartment of the planting bag with a double handful of wet moss, shingletow, or other wet material; the unopened bundles should be put in the other compartment, also with wet packing.

3. At intervals during the day the material in the planting bags should be moistened.

4. The trees in the planting bags should be kept covered and so handled that no root will dry out even for a moment.

5. A reserve supply of trees should be taken from camp by the foreman and heeled-in near the job, with which to replenish each planter's supply.

6. After the squad is lined up and ready to go the setting of the trees is accomplished in 7 steps, as follows: (See fig. 1.)

Step 1. Planter drives his grub hoe blade into the ground perpendicularly, its full length if possible in one stroke.

Step 2. Planter raises up on the handle to open hole at bottom.

Step 3. Planter thrusts the handle downward and at the same time draws the blade toward him, making thus a clean square hole.

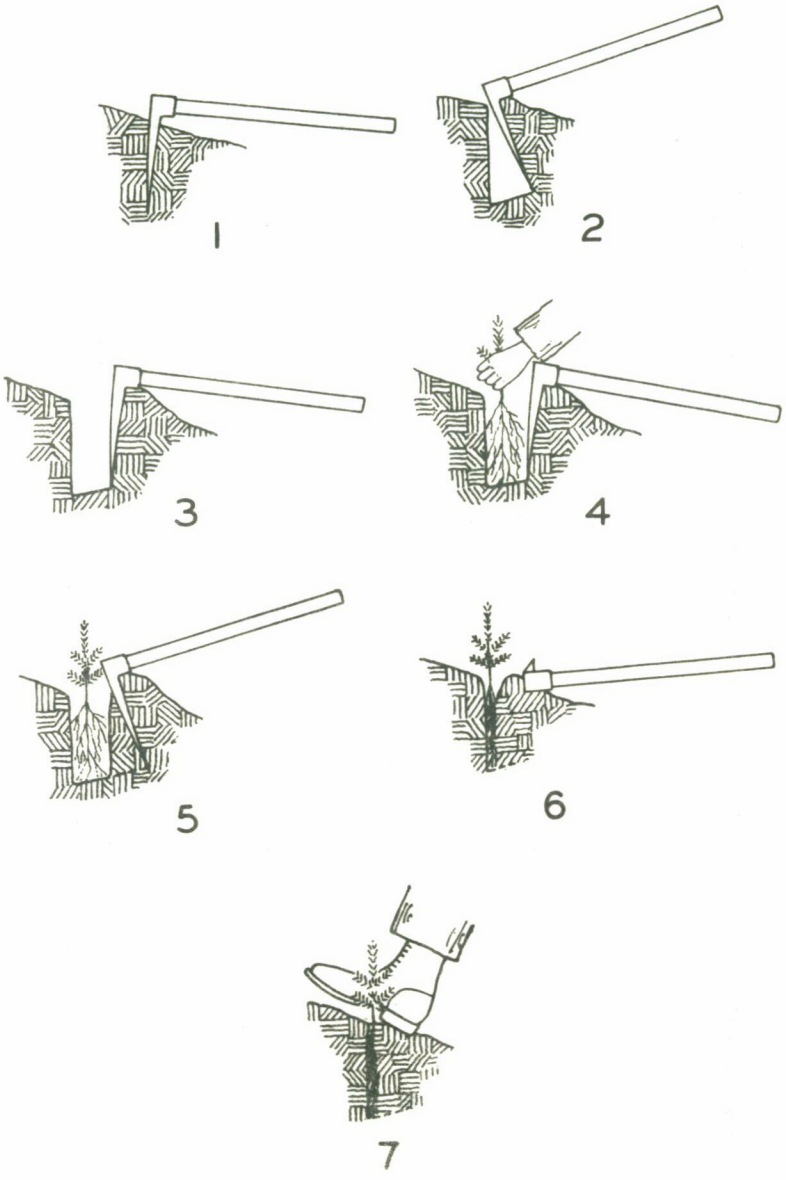
Step 4. Keeping blade of grub hoe in hole (to hold back the soil) he inserts 1 tree vertically; roots should be spread in the hole as naturally as possible, not twisted or allowed to hang together like a rope.

Step 5. Still holding the tree with one hand so that its former ground line is slightly below the ground line on the downhill side of the hole, he partly pulls out the blade and by reinserting it at an angle and giving a downward thrust presses a wedge-shaped mass of soil against the lower roots, filling the bottom of the hole.

Step 6. Remove the blade and with a downward push at the side fill the hole with soil full and solidly. If this step is properly done little further filling or tamping is necessary under most conditions.

Step 7. Before moving to the next tree, stamp with heel (not toe) beside the tree to

FIG. I.- SEVEN STEPS IN TREE PLANTING BY THE ONE-MAN GRUB HOE METHOD



firm soil. If this causes a depression scrape a little soil with hoe or shoe to fill up hole.

7. When planting in sod or dense vegetation it should be cleaned away by scalping the surface of an area a foot or two square before opening the hole. The hole should be large enough to easily accommodate the spread roots and should be free of obstructions that might catch or tangle the roots of the tree being planted.

8. In rocky soil it may be necessary either to make 2 or 3 tries before getting a deep enough slit-hole or to dig a hole with 2 or 3 strokes and place soil about roots in conventional fashion.

9. In sandy soil, which has a tendency to slide back into the slit, it may be necessary to remove some of it to get the hole deep enough for the roots. Do not allow dry surface sand to fill in around the roots.

10. The most important essentials of good planting which will result in high survival are:

(a) Never let the tree roots dry for even a moment; dry roots mean dead trees.

(b) Make the hole deep enough and wide enough to accommodate the roots easily with no doubling back of the tips.

(c) Set the tree no higher and not more than a little deeper than it was in the nursery.

(d) Fill the bottom of the hole, as well as the top, with soil and pack it solidly.

(e) Prevent rocks, dry soil, rotten wood, leaves, etc., from falling back into the hole against the roots.

11. The grub hoes should be kept sharp for easy and effective work by putting them on an emery wheel periodically.

## XI. Spacing of Rows and Trees and Selecting Right Spot for Each Tree in the Row

1. The standard spacing for planting in the Douglas-fir region is 8 feet between rows and trees 8 feet apart in the row or 681 trees per acre.

2. With large thrifty stock or on an especially favorable site a wider spacing might be employed but not over 10 x 10 or 436 trees per acre.

3. On difficult planting sites, particularly where the planting is cheap, the spacing might be closer. To get uniform results it may be well to plant more trees on south slopes than on north.

4. Where the travel is especially difficult it may be well to make the rows a little wider apart, 10 or even 12 feet, and the trees spaced a little closer, perhaps 5 or 6 feet, thus attaining about the same results and number of trees per acre at less labor cost.

5. Where there is a sprinkling of natural reproduction the spacing of the planted trees will be varied so as not to plant within 8 feet of an established tree.

6. Picking the right spot for setting a tree is more important than adhering to uniform

alignment or spacing. Hence, every planter should feel that he has a latitude of 3 feet or so in either direction to avoid unfavorable spots, but he must be sure after departing from his alignment or spacing to get back to it on the next tree.

7. The spots to select for setting a tree are:

(a) Where there is good, deep soil.

(b) On the north side of logs, stumps, bushes, etc., where the planted trees will be shaded.

(c) Where soil is stabilized.

8. The spots to avoid in setting a tree are:

(a) Mounds that might dry out.

(b) Depressions that might fill up with soil.

(c) Rotten wood.

(d) Spots where the soil is burned red by an extra hot fire.

(e) Spots of dense vegetation.

(f) Proximity of colonies of rodents and animal burrows.

## XII. Attention After Planting

1. It is often desirable to mark permanently the boundaries of plantations and this may be done by placing conspicuous corner posts, cloth or tin boundary notices, or appropriately worded signs at strategic points.

2. If domestic stock is permitted to graze in the locality it should be excluded from the plantations for at least the first 2 years.

3. If animals are observed to be especially destructive to the planted trees, steps should be taken at once to abate the trouble by trapping, poisoning, or shooting, for if uncontrolled they can almost ruin a young plantation in a year. See the discussion under "Pre-planting Animal Control".

4. It is highly desirable to follow up the results of planting by making examinations of survival periodically at the end of the first season and once or twice thereafter. This gives a measure of success of the work from which lessons can be learned as to the conduct of future projects. A satisfactory way of making survival counts is to stake sample rows with painted stakes 18 inches or more high. Staked rows should consist of 50 or 100 trees on a representative part of the area but crossing the direction of the planting rows so as to contain the work of all planters. Stakes should be heavy enough to last several years, and the rows should be referenced to landmarks, land survey corners, or plantation corners, and so recorded on the planting map.

## XIII. Reports

The foremen should keep each day, in addition to the usual time slip of each man's work, a record of the number of trees and the area planted. This information, in whatever detail and form prescribed for the project, should be reported to the project superintendent daily. He will keep such additional progress maps and records as are needed to meet the accounting and record demands of the employer.